RESPONSE TO THE SCIENTIFIC PANEL REVIEW REPORT

Chapter 4

CALIFORNIA TIGER SALAMANDER MODEL AND MITIGATION RECOMMENDATIONS

POTRERO HILLS LANDFILL PHASE II EXPANSION
SOLANO COUNTY, CALIFORNIA

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1.0 INTRODUCTION

1.1 MODEL DEVELOPMENT HISTORY

As part of the Bay Conservation and Development Commission's (BCDC) review of a Marsh Development Permit for the Phase II Potrero Hills Landfill (PHLF) expansion, an independent review was conducted by a panel of scientists to assist BCDC's evaluation of the potential effects of the Phase II expansion on biological resources, including evaluation of the mitigation plan for the proposed project (Airola et al., 2007). Chapter 4 of the review document provides the results of an analysis conducted by H. Bradley Shaffer, Ph.D. and Christopher Searcy (graduate student) from the University of California Davis of the biological impacts of the Phase II expansion project and the proposed mitigation on the California tiger salamander (*Ambystoma californiense*) (CTS) population at the landfill site. For their analysis, Shaffer and Searcy advanced a proposed quantitative model created by the authors to assign mitigation values to each acre of habitat at the landfill site. They then used this model to determine if the biological value of the proposed mitigation is equivalent to the biological value being lost for CTS. It should be noted that the model created by the review authors is not a recognized methodology for assessing biological value of CTS mitigation properties.

A draft of the CTS analysis conducted by Shaffer and Searcy was provided to PHLF in August 2006. At that time, PHLF consultants LSA Associates, Inc. (LSA) and Environmental Stewardship and Planning, Inc. (ESP) made comments on the model to BCDC and to Shaffer and Searcy directly. These comments focused on computation errors that appeared in the model and questions regarding the assumptions of the model.

A final version of the scientific review panel's report was published by BCDC and provided to PHLF in September 2007 (Airola et al., 2007). The final version of the model described in Chapter 4 is the basis for this review.

1.2 CTS MITIGATION DEVELOPMENT

The model created by Shaffer and Searcy represents a departure from the accepted standard methods used to determine mitigation value for impacts to CTS and their habitat currently employed by the U.S. Fish and Wildlife Service (USFWS) and California Department of Fish and Game (CDFG). The only methods currently recognized and published by the resource agencies for assessing impacts and determining mitigation for California tiger salamanders are biological opinions issued by USFWS, and the protocols developed in the *Santa Rosa Plain Conservation Strategy* (U.S. Fish and Wildlife Service, 2005b). In the *Santa Rosa Plain Conservation Strategy*, developed for the federally endangered Sonoma County Distinct

Population Segment (DPS) of the California tiger salamander, impacts to CTS and subsequent mitigation ratios are determined based on distance to breeding ponds.

Under the *Santa Rosa Plain Conservation Strategy* approach, impacted areas within 500 feet of a breeding pond require a 3:1 mitigation ratio, impacted areas between 500 and 2,200 feet of a breeding pond require a 2:1 mitigation ratio, and impacted areas between 2,200 feet and 1.3 miles of a breeding pond require a 1:1 mitigation ratio. The distances used to establish the various mitigation ratios in the *Santa Rosa Plain Conservation Strategy* are based on work by Trenham and Shaffer (Trenham and Shaffer, 2005); however, we are not aware of either researcher's direct involvement in establishing the requirements in the Conservation Strategy.

The model presented by Shaffer and Searcy requires a more complicated technique for analyzing impacts and developing mitigation for CTS that builds on the concept that lands closer to breeding ponds are of higher value to CTS due to the distribution of individuals of higher reproductive value being distributed closer to the breeding pond. The method employed in the model is much more sensitive to the placement of breeding ponds, particularly when applied to evaluation of the mitigation proposal.

Even though the model goes beyond simple mitigation ratios based on distance, the model still represents a simplification of the factors affecting a CTS population and only estimates the habitat value of lands to CTS. Due to the complexity of biological systems, quantitative models built to describe them always represent a drastically oversimplified version of reality (Gurney and Nisbet, 1998). The results of any model will inevitably depend on the assumptions inherent in the model structure (Gurney and Nisbet, 1998) and these assumptions can be investigated for their effects on the results.

Past attempts to use habitat modeling to assess and assign habitat impacts and mitigation compensation rates have suffered from problems associated with unrealistic weighting due to inaccurate model assumptions. USFWS has not, as of this date, used habitat or population models as the sole or primary measure to assess impacts or impact mitigation requirements for species protected by the Federal Endangered Species Act.

1.3 SCOPE OF MODEL REVIEW

This report, prepared by LSA and ESP on behalf of PHLF, provides a review of the Shaffer Searcy model, as presented in the *Scientific Panel Review Report* (Airola et al., 2007) and provides responses to the positions presented in the *Report*. This review of the model primarily focuses on some of the assumptions made in the original analysis by Shaffer and Searcy and provides additional results of model calculations based on reasonable modifications to the original assumptions. This review does not focus on the correctness or appropriateness of the

values used; as such a review is more appropriately undertaken in the peer reviewed literature.[1] Instead, this review focuses on some of the assumptions of the model and the implication of those assumptions on assessing project impacts and mitigation values. As biologists who regularly work with California tiger salamanders throughout its range, we are able to assess the model and some of its implications based on practical, first-hand experience dealing with impact assessments and mitigation development.

The analysis given in this document provides alternate assessments of the model results presented by Shaffer and Searcy (Airola et al., 2007). By running the model with a series of modified assumptions, we are able to evaluate the model's sensitivity to the initial assumptions made by Shaffer and Searcy and to evaluate alternative mitigation scenarios. Finally, we compared mitigation requirements derived from the Shaffer and Searcy model with the mitigation requirements derived from analyses using the mitigation ratios for the Sonoma County Distinct Population Segment (DPS) of California tiger salamanders and the East Contra Costa County Habitat Conservation Plan (ECC HCP). The Sonoma County DPS is federally listed as endangered and the only listed California tiger salamander DPS for which a conservation strategy including mitigation ratios has been published (U.S. Fish and Wildlife Service, 2005b). The mitigation requirements set forth in various biological opinions issued by USFWS and the protocols established in the *Santa Rosa Plain Conservation Strategy* are the accepted mitigation methodologies used by USFWS and CDFG to assess impacts to CTS.

1.4 PROJECT BACKGROUND

Figure 1 shows the layout of the Phase I (current) landfill, footprint of the proposed Phase II landfill and adjacent impacted areas, and proposed mitigation lands. The proposed landfill expansion will result in the conversion of 167.63 acres of primarily non-native grassland but also includes the fill approximately 2.42 acres of Section 404 jurisdictional wetlands and other waters of the U.S., 0.076 acre of isolated waters of the State, and 0.61 acre of pond habitat.

Within the landfill-owned parcels in the Potrero Hills, there are seven, man-made ponds, six of which are documented CTS breeding ponds (Ponds 1-5, and 7). Ponds 1 and 4 are located within the footprint of the proposed Phase II landfill, Pond 5 is located on an eastward extension of the Phase II parcel designated as the Pond 5 Buffer Area, Pond 7 is located on the Southern Hills parcel, and Ponds 2, 3, and 6 are located on the Eastern Valley parcel (Figure 1). The loss of Ponds 1 and 4 will be mitigated as part of the project. Ponds 5 and 7 also documented CTS breeding ponds will be preserved on mitigation lands (i.e., Pond 5 Buffer area and Southern Hills

[1] An important tool in the scientific review process is peer review in the technical literature, which is an accepted means by which to vet a subject matter and obtain critical comment and input from peers. This peer review is an important element to establishing acceptance in the scientific community. Such a review would include evaluation of the correctness and appropriateness of the values used in the model. Acceptance in the scientific community is a required element of establishing the credibility of expert opinion based on modeling and scientific test results.

parcels) as part of the project. All mitigation lands proposed as part of the project will be managed for the benefit of wildlife and plant habitat in perpetuity through a conservation easement and will have a management endowment. Ponds 2, 3, and 6 (also CTS breeding sites) located in the Eastern Valley, will not be impacted by the proposed project and the land will continue to be used as grazing land. However, neither a conservation easement nor a management endowment is proposed for the Eastern Valley.

In addition to the Southern Hills parcel and Pond 5 Buffer Area, a portion of the Griffith Ranch and entire Director's Guild parcels (Figure 1) will be preserved as plant and wildlife habitat through conservation easements. No CTS breeding habitat currently occurs on the Griffith Ranch parcel nor have adult salamanders been observed on the Griffith Ranch or Director's Guild parcels to date, but, about two-thirds of the Griffith Ranch parcel is located between 50 feet and 2,200 feet of Pond 1 (a CTS breeding site), and the entire Griffith Ranch and Director's Guild parcels are within 1 mile of Pond 1.

Approximately 4.07 acres of seasonal wetland and a 0.35-acre CTS breeding pond were originally proposed for construction on the Griffith Ranch parcel. In the original mitigation and monitoring plan (MMP) (LSA and ESP, 2006a), only the northern portion of Griffith Ranch was proposed for inclusion in the mitigation for the Phase II landfill expansion. The southern half of the parcel was to be left undeveloped except for the construction of a small power plant and sedimentation basin, and was not included in the mitigation lands. With the relocation of the power plant to a site within the existing Phase I landfill footprint and removal of the sedimentation basin from the Griffith Ranch parcel, an additional 48.56-acre portion of the Griffith Ranch parcel is now proposed for preservation as mitigation land. As part of the increased mitigation on the Griffith Ranch parcel, an additional 0.35 acre CTS breeding pond is now proposed at the location of the former power plant site in the southern portion of the parcel, approximately 1,100 feet northeast of Pond 1. This pond is in addition to the Griffith Ranch seasonal wetland complex and CTS breeding pond proposed in the original MMP and evaluated by Shaffer and Searcy.

A large playa pool on the Director's Guild site, located north of the proposed Phase II landfill area, may also serve as a potential relocation site for CTS. As part of the mitigation, the playa pool outlet pond would be modified to prevent fish that move up the drainage channel from Hill Slough from entering the playa pool complex. The playa pool complex begins on the Director's Guild site and continues to the east on parcels not owned by the landfill. The exclusion from fish from this area may make the playa pool more suitable for CTS breeding.

CTS adults have been found throughout the Potrero Hills Valley and Southern Hills during the winter surveys. Adult salamanders have been observed at the collapsed barn in the Eastern Valley, near Pond 5, near the spring box in the southwest portion of the Phase II parcel, in the seep area southeast of Pond 1, and in the Southern Hills near Pond 7. Essentially, all of the upper Potrero Hills Valley and Southern Hills support CTS.

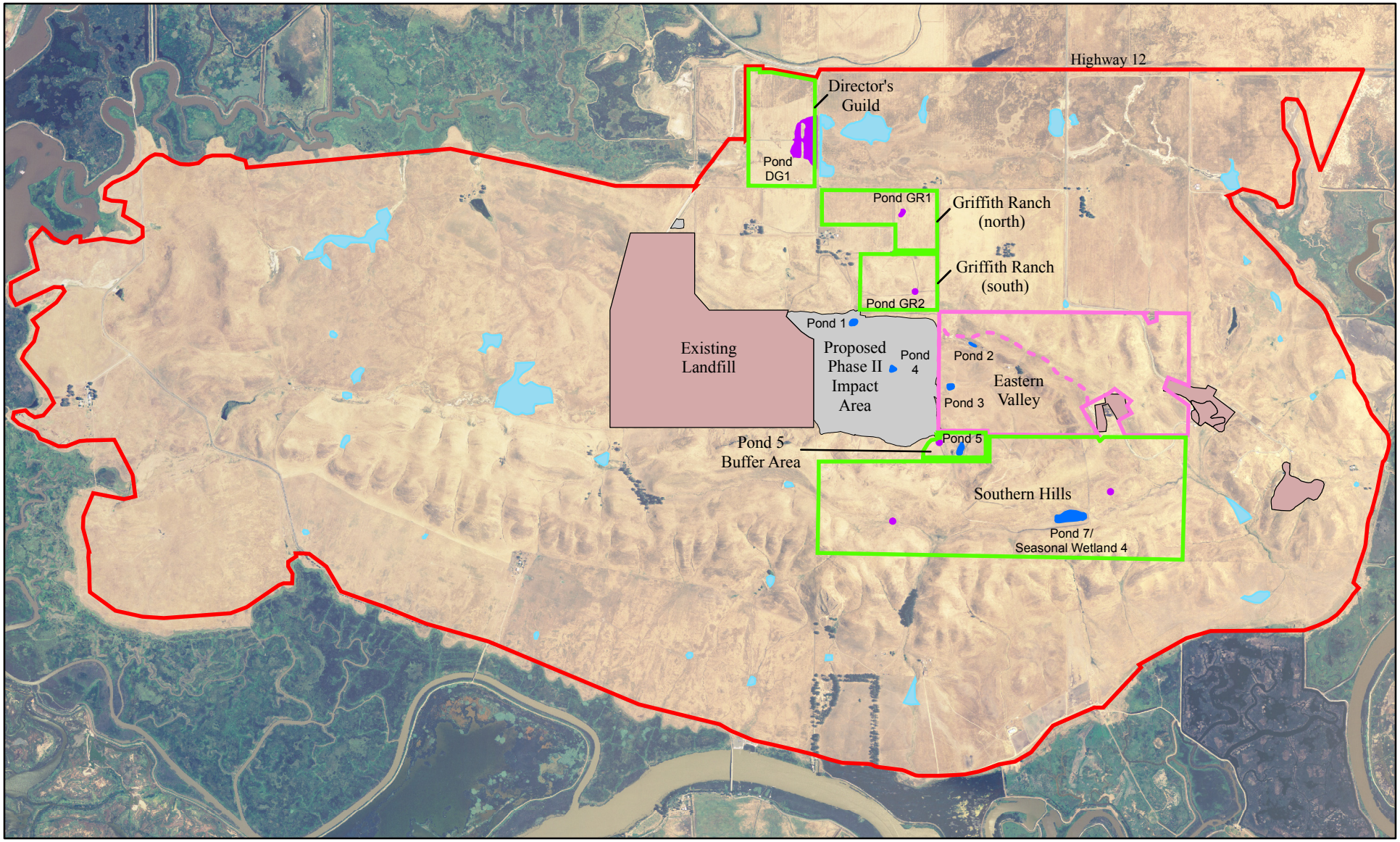

FIGURE 1

Potrero Hills Landfill Phase II Expansion

Potrero Hills Landfill Parcels

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Neither the Potrero Hills Valley nor any of the proposed mitigation parcels are designated as critical habitat[2] for CTS. However, designated critical habitat for vernal pool tadpole shrimp (*Lepidurus packardi*) and vernal pool fairy shrimp (*Branchinecta lynchi*) encompasses the entire Potrero Hills. Neither of these vernal pool crustaceans occur on the proposed Phase II expansion site as determined through protocol-level surveys, although both species are known to occur in areas north of the Potrero Hills, in particular on the Director's Guild parcel (vernal pool tadpole shrimp) and the Potrero Hills Lane mitigation site (vernal pool fairy shrimp). Critical habitat for Contra Costa goldfields (*Lasthenia conjugens*) and Conservancy fairy shrimp (*Branchinecta conservatio*) also includes portions of the Griffith Ranch and the Director's Guild parcel. Conservancy fairy shrimp and Contra Costa goldfields occur only on the Director's Guild parcel.

1.4.1 Original Mitigation Proposal (MMP)

The original mitigation proposal described in the original mitigation and monitoring plan (MMP) for the project (LSA and ESP 2006) and analyzed by Shaffer and Searcy included the following mitigation components:

- Preservation of upland habitat totaling 517.08 acres on the Southern Hills, Pond 5 Buffer, Griffith Ranch, and Director's Guild parcels,
- Preservation of 0.79 acres of existing CTS breeding habitat and 8.83 acres of potential CTS breeding habitat on the Southern Hills, Pond 5 Buffer, and Director's Guild parcels (9.62 acres total),
- Creation of an additional 0.73 acres of CTS breeding habitat on the Southern Hills (1 pond) and Griffith Ranch (1 pond) sites , and restoration of 0.42 acre of potential CTS breeding habitat in the playa pool on Director's Guild,
- Preservation of 5.52 acres of seasonal wetland on the Southern Hills and Griffith Ranch parcels, and 53.10 acres on the Director's Guild parcel,
- Creation of 4.07 acres of seasonal wetlands on the Griffith Ranch parcel,
- Preservation of 1.86 acres of waters of the U.S. on the Southern Hills and Director's Guild parcels, and
- Creation of 1.80 acres of waters of the U.S. on the Griffith Ranch and Director's Guild parcels.

[2] Critical habitat is defined as specific areas that are essential to the conservation of a federally listed species, and which may require special management considerations or protection. Critical habitat is determined using the best available scientific information about the physical and biological needs of the species. These needs, or "primary constituent elements," include: space for individual and population growth and for normal behavior; food, water, light, air, minerals or other nutritional or physiological needs; cover or shelter; sites for breeding, reproduction and rearing of offspring; habitat that is protected from disturbance or is representative of the historical geographic and ecological distribution of a species. (USFWS http://www.fws.gov/sacramento/es/crit_hab.htm#Critical_habitat)

Table A summarizes the total area of upland and aquatic mitigation by parcel as outlined in the original MMP.

Table A: Mitigation Acreage and Type by Parcel – Original MMP Version

	CTS Upland Habitat	CTS Pond Habitat		Seasonal Wetlands		Waters of the U.S.		Total (acres)
	Preserve	Preserve	Create	Preserve	Create	Preserve	Create	
Southern Hills	421.11	0.34	0.35	5.25	0.00	1.65	0.00	428.70
Pond 5 Buffer Area	17.65	0.45	0.00	0.00	0.00	0.00	0.00	18.10
Griffith Ranch	57.85	0.00	0.38	0.27	4.07	0.00	1.03	63.60
Director's Guild	20.47	8.83	0.42	53.10	0.00	0.21	0.77	83.80
Total	**517.08**	**9.62**	**1.15**	**58.62**	**4.07**	**1.86**	**1.80**	**594.20**
Mitigation Ratio*	**2.1:1**	**15.8:1**	**1.9:1**	**28.5:1**	**2.0:1**	**4.2:1**	**4.1:1**	

* Preserved/created:impacted

Total Impact Area = 244.93 acres, Wetland Impact area = 2.42 acres, Pond Impact Area = 0.61 acres (Ponds 1 and 4), Upland Impact Area = 241.9 acres

1.4.2 Revised Mitigation Proposal

With the changes that the PHLF has made to the location of the power plant and sedimentation basin on Griffith Ranch (i.e., the proposed relocation of a landfill gas-powered electrical generation facility and sedimentation basin from the Griffith Ranch to the existing and proposed landfill areas), additional areas will be incorporated into the mitigation lands for this project, namely additional upland habitat in the southern portion of the Griffith Ranch parcel and creation of an additional CTS breeding pond at the former power plant site. USFWS has begun its formal consultation review process, and based on the revised mitigation proposal the mitigation components would be as follows:

- Preservation of upland habitat totaling 565.29 acres on the Southern Hills, Pond 5 Buffer, Griffith Ranch, and Director's Guild parcels,

- Preservation of 0.79 acres of existing CTS breeding pond and 8.83 acres of potential breeding pond habitat on the Southern Hills, Pond 5 Buffer, and Director's Guild parcels (9.62 acres total),

- Creation of an additional 1.08 acres of breeding pond the Southern Hills (1 pond) and Griffith Ranch (2 ponds) sites, and restoration of 0.42 acre of potential breeding pond in the playa pool on Director's Guild,
- Preservation of 5.52 acres of seasonal wetland on the Southern Hills and Griffith Ranch parcels, and 53.10 acres on the Director's Guild parcel,
- Creation of 4.07 acres of seasonal wetlands on the Griffith Ranch parcel,
- Preservation of 1.86 acres of waters of the U.S. on the Southern Hills and Director's Guild parcels, and
- Creation of 1.80 acres of waters of the U.S. on the Griffith Ranch and Director's Guild parcels.

Table B summarizes the total area of upland and aquatic mitigation by parcel for the revised mitigation plan.

Table B: Revised Mitigation Acreage and Type by Parcel – Increased Griffith Ranch Plan (Shaded cells reflect changes from the values in Table A)

	CTS Upland Habitat	CTS Pond Habitat		Seasonal Wetlands		Waters of the U.S.		Total (acres)
	Preserve	Preserve	Create	Preserve	Create	Preserve	Create	
Southern Hills	421.11	0.34	0.35	5.25	0.00	1.65	0.00	428.70
Pond 5 Buffer Area	17.65	0.45	0.00	0.00	0.00	0.00	0.00	18.10
Griffith Ranch	106.06	0.00	0.73	0.27	4.07	0.00	1.03	112.16
Director's Guild	20.47	8.83	0.42	53.10	0.00	0.21	0.77	83.80
Total	**565.29**	**9.62**	**1.50**	**58.62**	**4.07**	**1.86**	**1.80**	**642.76**
Mitigation Ratio*	**3.4:1**	**15.8:1**	**2.5:1**	**28.5:1**	**2.0:1**	**4.2:1**	**4.1:1**	

*preserved/created:impacted

Total Impact Area = 167.63 ac, Wetland Impact area = 2.42 ac, Pond Impact Area = 0.61 ac (Ponds 1 and 4), Upland Impact Area =164.60 ac

1.5 MODEL BACKGROUND

1.5.1 Biological and Analytical Assumptions of the Shaffer Searcy Model

The model presented by Shaffer and Searcy (Airola et al., 2007), makes several biological and analytical assumptions. These assumptions directly affect the analysis of impacts that can be attributed to the project and the mitigation that would be required to compensate for those impacts. The limits of the assumptions will be discussed in Section 4. The assumptions used by Shaffer and Searcy in their analysis are listed in the review document (Airola et al., 2007) and summarized below.

1. CTS migrate to and from breeding sites, and their distribution on the terrestrial landscape depends on distance from a breeding site, as well as the age of the animal. Age-specific density distributions based on capture data from nearby Jepson Prairie, Solano County were used in the analysis (Trenham and Shaffer, 2005; Shaffer and Searcy, 2007).

2. CTS move to and from their breeding sites in straight lines. The authors have only limited data to support this assumption, and state that it is a reasonable, simple assumption that is consistent with the results of their field studies in Monterey County. Under this assumption, the Phase II expansion area effectively blocks all movements (estimated as straight-line distances) from a breeding site to areas on the opposite side of the expansion area.

3. Animals of different ages have different values to the total population. Based on data collected over an 8-year period in Monterey County (Trenham et al., 2000) and the review authors' last 2 years of data at Jepson Prairie, they established a relative weighting scheme to assign reproductive values to metamorphs, juveniles, and breeding adults (see scientific review Chapter 4 for details on this weighting). This weighting scheme uses the probability of survival of each age class to breeding age.

4. Shaffer and Searcy combined the survival-based weighting scheme with the density distribution of different age class animals across the landscape to calculate, for each breeding site (ponds 1, 2, 3, 4, 5, and 7), the reproductive value of each acre of land that is lost to the Phase II landfill expansion and the reproductive value of each acre of land provided by the Director's Guild, Griffith Ranch, and the Southern Hills mitigation parcels.

5. Shaffer and Searcy considered all other lands, including the Eastern Valley area (i.e., valley lands just east of the Phase II area) as unaffected—that is, as neither a benefit nor a loss to the salamanders.

6. Shaffer and Searcy did not include the power plant or sedimentation basin sites in their calculations. The authors had been informed that the power plant would be

relocated from the southern Griffith Ranch to a site within the existing Phase I landfill and so it was not considered an impact in the calculations of pre- or post- project habitat value. Other than direct habitat loss, they did not consider any other direct or indirect effects on CTS. They also did not include the positive or negative effects on salamanders that may breed offsite (i.e., from breeding ponds that are not on the Phase II, mitigation, or Eastern Valley lands) but that may use areas on the mitigation lands as terrestrial habitat.

7. The calculations of habitat value were assessed on an acre-for-acre basis (i.e., they calculated the biological value of each acre that is lost and each that is gained through protection and possible enhancement). The authors recommend ratios that they think are appropriate and acknowledge that the final mitigation ratios would be determined in consultation with the USFWS.

8. The value of upland habitat being evaluated was based only on the distance and connection of those uplands to those ponds protected within contiguous mitigation lands.

   Additional assumptions are made later on in the Shaffer and Searcy report during the calculation of direct habitat loss.

9. The model assumes that each pond contributes equally and additively to the recruitment pool of breeding adults.

10. The model assumes that the system is working at capacity and that adding more ponds will neither help nor hurt in terms of the total number of breeding adults at the entire site.

11. Although adult salamanders have been observed at Pond 6, it was not included in the analysis as this pond does not appear to be used regularly by CTS as a breeding site. CTS larvae have not been observed in this pond.

1.5.2 Structure of the Shaffer and Searcy Model

The mitigation model developed by Shaffer and Searcy (Airola et al., 2007) uses data from Trenham et al. (2000) for the survival probabilities of metamorphs and juveniles. Data on the density distributions of metamorphs, juveniles, and adults comes from the authors' 2005–2006 trapping studies at Olcott Lake, Solano County (See Appendix A). These data were then used to estimate the relative reproductive value of land around a breeding pond.

The relative reproductive value of an adult was set at a value of 1.0, and the relative reproductive values of the other age classes was assigned as their probabilities of surviving to maturity. These probabilities were calculated based on data from Trenham et al. (2000), who gives the average age to maturity for CTS as 4 years, with 30 percent surviving during the first year and 55 percent

surviving during each subsequent year. Based on these values, Shaffer and Searcy (Airola et al., 2007) calculated the relative reproductive value of an average juvenile to be 0.37 and the relative reproductive value of a metamorph to be 0.08. The density distributions of the different age classes at various distances from Olcott Lake were weighted by these relative reproductive values and added together to produce a density distribution of reproductive value as a function of distance from the shoreline of a pond (See Appendix A). The percentage of the reproductive value of the population that is protected is in turn directly correlated with the future viability of the population.

The curve of the density distribution of reproductive values was then converted into a curve of mitigation values (See Appendix A). The proposed mitigation value curve has the same shape as the density distribution of reproductive values, assigning relative mitigation values to lands at various distances from a breeding pool that are equivalent to its relative biological value to a salamander population. Additionally, the curve was scaled such that the total mitigation value (i.e., the total area under the curve) for land within 1 mile of a pond is equal to the total mitigation value for that same mile under a 1:1 constant mitigation ratio. Thus, the area under the curve is identical to the area if one were to accomplish a 1:1 mitigation ratio for all of the land within 1 mile of a breeding pond without any biological weighting considerations.

2.0 METHODS

For purposes of conducting the review of the model created by Shaffer and Searcy, we have assumed for analytical purposes that the basic approach of the model is sound and that differences between the value of the Company's mitigation proposal and the Shaffer and Searcy interpretation is due to differences in the assumptions used in calculating the values in the model. In order to test this, we conducted several analyses to assess the effects of certain model assumptions on the results of model calculations presented by Shaffer and Searcy (Airola et al., 2007). These assumptions include Assumption 5, which does not include the Eastern Valley parcel as either a loss or benefit to salamanders, Assumptions 6 and 8, which confine the analysis to the scale of the project site, and Assumption 10, which gives no credit to the creation of potential replacement ponds. Table C summarizes the different analyses conducted in this review. The details of each analysis are discussed in the sections below.

Table C: Summary of the Analyses Conducted by PHLF Using the Model Developed by Shaffer and Searcy and Modifications to Model Assumptions.

Analysis†	Assumptions Modified	Ponds included in Calculations of Post Project Mitigation Value	Associated Sections, Figures and Tables
1. Model Verification	None	Ponds 5 and 7	Section 2.1 and Figures 2-4
2. Inclusion of Eastern Valley	5	Ponds 2, 3, 5, and 7	Section 2.3.1 and Figure 5
3. Landscape Analysis (inclusion of offsite ponds)	6 and 8	Ponds 2, 3, 5, 7, and offsite ponds	Section 2.3.2 and Figure 6
4. Inclusion of Replacement Ponds: Original MMP	10	Ponds 5, 7, DG1, GR1, and Pond 7 addition	Section 2.3.3 and Figure 7
5. Inclusion of Replacement Ponds: Revised MMP	10	Ponds 5, 7, DG1, GR1, GR2, and Pond 7 addition	Section 2.3.3 and Figure 8
6. Inclusion of offsite ponds and replacement ponds: Original MMP	6, 8 and 10	Ponds 2, 3, 5, 7, DG1, GR1, Pond 7 addition, and offsite ponds	Section 2.3.4 and Figure 9
7. Inclusion of offsite ponds and replacement ponds: Revised MMP	6, 8 and 10	Ponds 2, 3, 5, 7, DG1, GR1, GR2, Pond 7 addition, and offsite ponds	Section 2.3.4 and Figure 10
‡ Santa Rosa Plains Conservation Strategy Analysis	Not Applicable	Not Applicable	Section 2.4.1 and Figure 11
‡East Contra Costa County Habitat Conservation Plan	Not Applicable	Not Applicable	Section 2.4.2 (no figure)

† For all of the analyses, Ponds 1-5 and 7 were used to calculate the pre-project habitat values, with the exception of analyses 3, 6 and 7, which also include offsite ponds.

‡ Santa Rosa Plain Conservation Strategy and East Contra Costa County Habitat Conservation Plan analyses are not based on the Shaffer and Searcy model and are included in the table only to show the report sections and figure associated with these analyses.

2.1 MODEL VERIFICATION

In order to verify that we could reproduce the model results, the Shaffer and Searcy model was recreated using ArcGIS[3]. The mechanics of the model were not explicitly detailed in Shaffer and Searcy's report, and so some discrepancy was expected between the results presented in their report and our model runs. In the verification process, we adhered to the original assumptions set forth by Shaffer and Searcy (Airola et al., 2007). The upland habitat surrounding a pond/point was treated as a grid and using the values projected from the model (i.e. from the curve of mitigation ratios illustrated in Appendix A), each polygon on the grid was given a value. The value of the land is calculated as "acre equivalents" of habitat value, which, based on the model presented by Shaffer and Searcy (Airola et al., 2007) and reproduced in Appendix A, are a measure of the relative reproductive value of the upland habitat for lands surrounding a breeding pond. Values are accumulated independently for each pond to derive total gains and losses associated with each pond, each parcel, and a net value of directly impacted and protected mitigation lands.

Using Shaffer and Searcy formulas, the value for all upland areas within 1 mile of a pond were calculated and impacts to each pond from the proposed Phase II landfill expansion were calculated. As in the original Shaffer and Searcy model, the value of the land preserved on the mitigation sites was calculated in the same way. Again, the original assumptions of the Shaffer and Searcy model were employed and only breeding ponds and lands around them that were proposed as mitigation lands were included in the calculations. The calculated value of the impacted areas and mitigation areas were then compared. Negative values indicate habitat values lost due to project construction and positive values indicate gains from mitigation lands.

2.2 MITIGATION PROPOSALS

Shaffer and Searcy interpreted the mitigation in a highly restrictive way that gave credit only to ponds 5 and 7, gave no credit to replacement ponds, and did not count the Director's Guild as CTS habitat. *We strongly disagree with this interpretation.* As such, in our analyses using the model, we included mitigation ponds in calculations of the mitigation value and included the Director's Guild site as CTS habitat. The features that were included in the analyses are described below.

In the original MMP (summarized in Section 1.4.1), we proposed constructing a CTS breeding pond in the northern portion of the Griffith Ranch site (GR1). This pond is associated with the larger seasonal wetland complex that is also proposed for construction on this site. The pond would be located within about 2,500 feet of Pond 1, a confirmed CTS breeding pond. The pond would be approximately 0.38 acres in size and approximately 2 feet deep. The hydrologic analysis of the site indicates that in an average year, the mitigation pond would hold 1-2 feet of water between December and May (Swanson Hydrology, 2007), a period long enough to allow

[3] ArcGIS version 9.1. ESRI. Redlands, CA.

CTS to breed and complete metamorphosis in an average year. The remaining uplands in the northern portion of the site were also included as mitigation lands for CTS. Both the pond and the preserved uplands were included in our analyses of the mitigation lands using the model. We also analyzed the revised mitigation proposal described in Section 1.4.2. In the revised proposal a second CTS breeding pond (GR2) would be created in the southeastern portion of the Griffith Ranch site. This pond would also be about 0.35 acres and be designed with a hydroperiod sufficient for CTS reproduction and recruitment. The pond would be located within 1,000 feet of Pond 1. An additional 48.21 acres of uplands would also be added to the mitigation proposal making 48.56 acres of the southern portion of the Griffith Ranch parcel part of the mitigation lands.

We also included in our analyses the creation of a second, deeper pond in the Seasonal Wetland 4/Pond 7 complex on the Southern Hills parcel. The 2005-2006 rain year saw well above average rainfall in Solano County and throughout most of California, resulting in a condition in the Seasonal Wetland 4/Pond 7 complex that had not been seen by the authors of this report during the previous 6-7 years: namely bank full conditions throughout the wetland/pond complex well into late spring and early summer. This condition was highly unusual. Typically by May of an average year, most of the wetland/pond complex is dry with standing water remaining only at the east end of the wetland/pond complex near the berm of Pond 7. In May 2006, the entire wetland/pond complex provided aquatic habitat for thousands of CTS larvae, all of which were expected to be able to metamorphose and leave the pond well before the pond dried up. This was a significantly different situation from past years, when only a small 0.34-acre pond remains in the Seasonal Wetland 4/Pond 7 complex. Many CTS larvae that were not in the eastern end of the complex became stranded and died in the wetland portion of the complex before they transformed to terrestrial metamorphs. By creating a second deep pond in the Seasonal Wetland 4/Pond 7 complex, we can provide additional breeding habitat with sufficient hydroperiod (Swanson Hydrology, 2007) to allow additional CTS larvae to complete their metamorphosis and not get stranded and die in the seasonal wetlands. For this reason, all of our calculations on the original and revised mitigation plans include a second deep pond in the Seasonal Wetland 4/ Pond 7 complex.

Finally, we included the Director's Guild site in our calculations of the original and revised mitigation plans because we also disagree with the conclusion reached by Shaffer and Searcy. They assert that CTS never occurred in the playa pool at the Director's Guild based on our lack of CTS observations during aquatic surveys of the pool. Although we have not found CTS at the site, we believe that another explanation for the absence of CTS is also possible.

First, we have documented that the playa pool on Director's Guild is inhabited by fish during the winter. The man-made ditch that drains the playa pool connects directly to Hill Slough across the Potrero Hills Lane mitigation site east of the Director's Guild site. Predation by fish on CTS and their larvae could explain the absence of this species from the playa pool. For over 50 years, the playa pool has been connected directly to the slough via the ditch and long-term predation of breeding salamanders on this site could have resulted in their extirpation. We further believe that

Shaffer and Searcy overstate their case when they assert that the Director's Guild site has never been CTS habitat as this not consistent with the observations of CTS in the vicinity:

1. The playa pool is within approximately 3,500 feet of a confirmed breeding pond (Pond 1) and as such could provide upland habitat to a small proportion of the salamanders that breed in Pond 1 (or possibly CTS from a second potential breeding pond within about 2,500 feet on the Guidotti property); and

2. CTS are known from both north and south of the Director's Guild site and it is reasonable to assume that this natural playa pool would have been occupied historically. CTS occur in the stock ponds of the Potrero Hills south of the Director's Guild site and north of the Director's Guild site on the North Suisun Mitigation Bank, the Jepson Prairie Preserve and across the Jepson Prairie north and east of the site including Muzzy Ranch, Wilcox Ranch, and Gridley Mitigation Bank.

Other records occur further north in the Fairfield and Vacaville areas. The Director's Guild site falls on the western edge of the currently known range in Solano County and was likely occupied historically if not presently. Given the distribution of CTS in the vicinity of the site and the proximity of known breeding sites to suitable breeding and upland habitat, in our professional judgment we believe that it is appropriate to consider the Director's Guild site as potential habitat.

2.3 MODIFICATIONS TO THE MODEL ASSUMPTIONS

Shaffer and Searcy present sufficient data from previous studies (Trenham et al., 2000;Trenham and Shaffer, 2005) to support assumptions 1 through 4, with the possible exception that salamanders only move in a straight line. However, even though there is data suggesting that CTS will move in directions other than a straight line, particularly when a barrier is reached, for simplicity of model calculations, this assumption was maintained. For purposes of the model calculation, assumptions 7, 9, 10, and 12 were also maintained. Modifications were only made to assumptions 5, 6, 8, and 10.

2.3.1 Inclusion of the Eastern Valley (Modification of Assumption 5)

Because Shaffer and Searcy included this parcel in their analysis, we too looked at this parcel in our analysis. This parcel has not been included in the Landfill's mitigation proposal and its inclusion in this review is for comparative purposes only. Using the model, we calculated the increased value of the mitigation lands if the Eastern Valley parcel was included in the analysis.

2.3.2 Landscape Analysis (Modification of Assumptions 6 and 8)

Assumptions 6 and 8 confine the analysis to the scale of the project site (i.e., impacted area plus proposed mitigation areas). The scale at which a model is applied can have profound affects on

the results (Tilman and Kareiva, 1997). Suitable habitat occurs in the annual grasslands and freshwater ponds throughout the Potrero Hills. Since the Potrero Hills are bounded by marshlands to the east, west, and south, and State Highway 12 to the north (due to traffic volumes on the highway, this feature forms a barrier to movement by tiger salamanders), they form a natural island of habitat inhabited by CTS. Therefore, we conducted an analysis on a landscape scale rather than a project scale, by incorporating offsite ponds found within the surrounding hills.

For purposes of this analysis, all annual grasslands and ponds in the hills were considered suitable habitat for CTS and were included in the analysis with a few exceptions. Ponds were excluded from consideration as breeding habitat if they were known to be perennial or received tidal influence from the marsh. Ponds were identified from aerial photographs of the Potrero Hills. Grasslands were considered suitable unless they were developed and formed an impassable barrier. Farmsteads for example were not considered barriers to CTS movement, but the existing landfill and industrial areas (i.e., Explosive Technologies) were.

2.3.3 Creation of Replacement Ponds (Modification of Assumption 10)

Assumption 10 gives no credit to the creation of potential replacement pools, assuming that they will not contribute to the recruitment of breeding adults. Shaffer and Searcy state that there is currently no information suggesting that CTS will occupy potential replacement pools in the future. We believe that the rationale for this assumption is weakly supported.

Ponds in the Potrero Hills are all stock ponds, not naturally occurring vernal pools, meaning that CTS would have had to colonize these ponds following their construction. Additionally, numerous CTS impact mitigation projects (e.g., Sycamore Grove Park mitigation site – Livermore, Eagle Ridge project site – Gilroy, Shiloh Mitigation Site – Sonoma County, Elsie Gridley Mitigation Bank – Solano County, Ruby Hills – Livermore) have demonstrated that CTS colonize mitigation ponds or stock ponds following their creation. The original Mitigation and Monitoring Plan for the Phase II Potrero Hills Landfill Expansion Project (MMP) (LSA and ESP 2006), calls for the creation of one new pond on Griffith Ranch. With the relocation of the power plant to the Phase I landfill, a second pond at the power plant location is also proposed. In addition, we have included a second pond in the Southern Hills constructed in the large seasonal wetland (Seasonal Wetland 4) adjacent to Pond 7. In average rainfall years, this deepened portion of the seasonal wetland is expected to function as a second pond that will hold water long enough to allow CTS larvae to metamorphose. In exceptionally wet years such as 2006 (when the review panel made their field visits), the deepened portion of the wetland will be part of the large Pond 7/Seasonal Wetland 4 complex which can support larvae to metamorphosis throughout most of the complex. All of the CTS mitigation ponds will be constructed with dimensions adequate to allow ponding for approximately 12 weeks. A hydrological study of the Griffith Ranch and Southern Hills indicate that the mitigation ponds are feasible and that they would hold water for a sufficient duration and at a sufficient depth to allow successful reproduction and recruitment by CTS (Swanson Hydrology, 2007). We have used the location of

the ponds as shown in the original MMP (LSA and ESP 2006) and as described in this document (new ponds at the power plant location) to calculate the credit for ponds using the model.

2.3.4 Inclusion of Offsite Ponds and Replacement Ponds (Modification of Assumptions 6, 8, and 10)

After testing the effects of modifying the assumptions of scale (i.e. incorporating the value of offsite breeding habitat) and the assumption that replacement pools will not contribute to the recruitment of breeding adults, we combined these modifications and conducted two new analyses. In these analyses, the model was used to assess the effects of modifying more than one assumption. The inclusion of offsite ponds, as discussed in the landscape analysis and the inclusion of replacement ponds was examined for the mitigation proposed in the original MMP and for the revised mitigation proposal.

2.4 ADOPTED CONSERVATION PLANS

2.4.1 Santa Rosa Plain Conservation Strategy Analysis

Mitigation for impacts to CTS upland and aquatic habitat were also calculated using the methods specified in the interim mitigation measures for CTS in the *Santa Rosa Plain Conservation Strategy* (U.S. Fish and Wildlife Service, 2005) and the *Programmatic Biological Opinion for U.S. Army Corps of Engineers Projects that May Affect California Tiger Salamander and Three Listed Plants on the Santa Rosa Plain, California (Corps File Number 223420N)* (U.S. Fish and Wildlife Service, 2007). Until the conservation strategy is fully implemented by the local jurisdictions, an interim set of mitigation ratios are being used for projects that affect the federally endangered DPS (distinct population segment) of the California tiger salamander in Sonoma County. Upon full implementation of the conservation strategy, all areas within 1.3 miles of a known or extirpated breeding site will be subject to a mitigation ratio of 2:1 (preserved:impacted). The current interim mitigation ratios[4] are as follows:

- Mitigation of 3:1 – For projects that are within 500 feet of a known breeding site.
- Mitigation of 2:1 – For projects that are greater than 500 feet, and within 2,200 feet of a known breeding site, and for projects beyond 2,200 feet from a known breeding site, but within 500 feet of an adult occurrence.
- Mitigation of 1:1 – For projects that are greater than 2,200 feet, and within 1.3 miles of a known breeding site.

[4] A fourth mitigation ratio is applied to areas greater than 1.3 miles from a known breeding site that have potential for CTS occurrence and that are not included in the "No Effect" areas shown in the Programmatic Biological Opinion. This ratio of 0.2:1 (preserved:impacted) is specific to the Santa Rosa Plain Conservation Strategy area and would not apply to other areas where such potential presence has not been determined.

In order to assess impacts and required mitigation according to this conservation strategy, we used ArcGIS to determine the amount of land within each of the distances from each breeding pond affected by the Phase II expansion. Where bands of habitat from two or more ponds overlap, the mitigation required for the overlap area was calculated using the highest mitigation ratio. For example, if an area to be impacted is 400 feet from breeding pond A, and 1,000 feet from breeding pond B, the mitigation requirement for the area of overlap would be 3:1 not 2:1. Accordingly, mitigation ratios are not additive in this analysis.

2.4.2 East Contra Costa County Habitat Conservation Plan and Other Plans

Although mitigation ratios for each species covered under the East Contra Costa Habitat Conservation Plan (ECC HCP) (Jones & Stokes, 2006) are not specified by species, by examining the commitment of preserved land versus authorized take in the ECC HCP it is possible to derive mitigation ratios for various species. For California tiger salamanders, the overall ratio is 6:1 for upland habitat and 2:1 for breeding. Under the ECC HCP, the project applicant is responsible for about one half of the upland preservation, in this case 3:1 (preserved:impacted), and all wetland/breeding habitat impacts. The other half of the mitigation requirement is to be paid for by public and other private sources. ECC HCP is the first "modern" Regional Plan to be approved in northern California and sets precedence for other regional plans that are in preparation such as the Solano Habitat Conservation Plan (Solano HCP)(Solano County Water Agency, 2007). In the current draft of the Solano HCP, a mitigation ratio of 3:1 for California tiger salamander upland habitat is proposed.

Regional HCPs take many years to complete, involve numerous stakeholders (i.e., state and federal fish and wildlife agencies, counties, cities, and private landowners), and to the agencies, represent the best available, collective information for the conservation requirements for a species. California tiger salamanders in Contra Costa, Solano, San Joaquin, and Sacramento counties are all considered to be in the same regional population. San Joaquin County has an older approved regional HCP, and CTS upland mitigation is also 3:1 in that plan.

In addition to the habitat preservation requirements, regional HCPs provide other conservation benefits and outside entities doing their own Section 7 permits will likely have to follow the adopted regional plan, plus possibly add a penalty, to make up for the lost broader HCP benefits, plus the plan preparation costs. The ECC HCP is primarily set up as a direct cash payment plan (land dedication is allowed in some cases). ECC HCP and USFWS have talked about letting projects outside of the HCP pay into their reserve acquisition fund (currently around $22,000 per acre of impact) at a rate of 50 percent of the derived mitigation ratio, plus a penalty of anywhere from 10 to 25 percent for additional land and other costs. Including the additional fees in the cost of the mitigation, the derived mitigation ratios for upland impacts could range from 3.33:1 to 3.75:1.

We compared the mitigation proposed by PHLF with the mitigation requirements of the ECC HCP in which California tiger salamander has been included. This comparison was made on a

gross acreage basis and does not include any weighting with respect to distance to breeding ponds or other factors.